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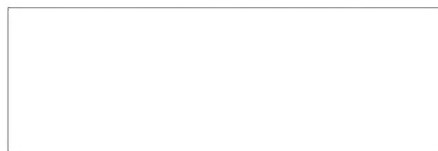
**MICROWAVE
RADIO RELAY STATIONS
IN SOUTH AFRICA (TSR)**

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MICROWAVE RADIO RELAY STATIONS IN SOUTH AFRICA (TSR)

1. (TSR) This report is a comprehensive update to NPIC report [] which describes microwave radio relay communications stations identified on imagery of South Africa. An analysis of these microwave radio relay stations [] has resulted in a significant refinement of the mensural data in the initial report.¹ Also, 151 additional stations were identified from a review of all available imagery of South Africa. To date, a total of 213* stations with towers supporting or possibly supporting microwave antennas has been identified in South Africa.** Two of these stations are shown in Figures 1 through 3. Figure 4 is a map showing the radio relay network in South Africa, and Table 1 is a list of all pertinent data.

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2. (TSR) Microwave parabolic dish antennas of three different sizes—approximately 2.0, 3.0, and 4.0 meters in diameter—appear to be used in South Africa. Generally, the 2.0-meter antenna appears to be used in the sparsely populated western desert and border regions; the 3.0-meter-diameter antenna is used in the more populous southern and central regions; and the 4.0-meter-diameter antenna is used in the densely populated northern region and in some major cities. Often, two or more parabolic dish antennas identical in size have been identified oriented on the same azimuth from the same tower. This suggests that some antennas may be arranged for frequency/space diversity. No horn-type antennas were identified.

3. (TSR) Significant construction activity was observed in the northwestern and northeastern portions of the South African microwave radio relay network. In the northwestern portion of the network, a masonry tower of the type used to support microwave radio relay antennas was in an early stage of construction at a new station, Keimoes Radio Relay Station (item 21, Figure 4). In the northeastern portion of the network, significant construction activity was observed at two locations. A self-supporting lattice tower and an adjacent control building were in the late stages of construction at a new station along the coast, Richards Bay Radio Relay Station (item 144, Figure 4). Also, a self-supporting lattice tower with three parabolic dish antennas has recently been constructed at an existing inland microwave radio relay station, Standerton Radio Relay Station (item 19, Figure 4, and area B, Figure 2). Evidence of imminent, widespread construction activity was also observed in the northeastern portion of the network. Two parabolic dish antennas were in open storage near existing lattice towers at the following stations: Standerton Radio Relay Station (item 19, Figure 4, and area A, Figure 2), Hillcrest FM Transmitter South African Broadcast Company (SABC) and Radio Relay Station (item 41, Figure 4), Paardekop Radio Relay Station (item 149), Newcastle Radio Relay Station (item 162), and Estcourt Radio Relay Station (item 184). These parabolic dish antennas will probably be mounted on the lattice towers in order to upgrade/expand the radio relay communications link between Johannesburg and Durban.

¹Items 46 and 53 in Table 1 and Figure 1 of the initial report¹ were found to be the same facility, item 53 having incorrect geographic coordinates. As a result, only 62 of the 63 initially reported stations are valid. In this report, the number 53 in Table 1 and Figure 4 has been assigned to a newly identified station which is confirmed.

^{**}Since several radio/TV broadcast towers have discernible microwave radio relay antennas mounted on them, all such towers were annotated on Figure 4 and were assumed to be associated with both microwave radio relay and radio or TV broadcast communications.

REFERENCES

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MAPS OR CHARTS

DMA. Joint Operations Graphic, Series 1501, scale 1:250,000 (UNCLASSIFIED)

DOCUMENTS

1. NPIC. [] PIR-031/77, *Microwave Radio Relay Facilities in South Africa (TSR)*, Oct 77 (TOP SECRET RUFF []) 25X1
2. DOD [] (U) *South African Micro-Wave/Television System*, 3 Apr 70 (UNCLASSIFIED) 25X1
3. CIA/DDO/DIV D/CIB (OSO/SCO) [] *Pretoria, South Africa Survey Report*, 5 May 75 (SECRET []) 25X1

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RELATED DOCUMENT

CIA. NIS 61 Sec 38 (Rev), *South Africa Telecommunications*, Oct 68 (CONFIDENTIAL []) 25X1

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Table 1. Data on Microwave Radio Relay Facilities Identified in South Africa (Keyed to Figure 4)
 This table in its entirety is classified TOP SECRET RUFF

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
1	Ellisras Radrel Sta	23-38-43S 027-57-36E	070786	3,800	Lattice/ []	Parabolic dish
2	Potgietersrus Radrel Sta	24-06-18S 029-11-46E	070787	5,665	Lattice/61	Undet
3	Munnik AM BC A Radrel Sta	23-47-46S 029-59-56E	070788	5,904	Vertical Radiator/ []	Undet
					Lattice/undet	Undet
4	Thabazimbi Radrel Sta	24-29-16S 027-42-49E	070789	6,055	Lattice/66	Undet
5	Zwartruggens Radrel Sta	25-18-29S 026-41-44E	070790	4,765	Lattice/62	Undet
6	Lichtenburg AM BC A Radrel Sta North	25-51-50S 026-03-01E	070791	5,000	Vertical Radiator/247	Parabolic dish
7	Koster Radrel Sta	25-57-13S 026-42-22E	070792	5,683	Lattice/36	Rectangular screen
8	Rayton Radrel Sta	25-48-47S 028-30-17E	070726	5,182	Lattice/36	Parabolic dish
9	Bronkhorstspuit Radrel Sta NE	25-36-09S 028-57-27E	070727	5,551	Lattice/81	Undet
10	Bronkhorstspuit Radrel Sta SE	25-53-16S 028-58-03E	070728	5,000	Lattice/52	Parabolic dish Parabolic dish
11	Middelburg FM Xmtr SABC A Radrel Sta	25-49-52S 029-22-41E	070729	6,089	Vertical Radiator/255	Undet
					Lattice/ []	Parabolic dish Parabolic dish Parabolic dish
12	Johannesburg AM Xmtr Maraisburg SABC	26-13-02S 027-54-59E	070730	6,120	Vertical Radiator/159	Undet
13	Coligny Radrel Sta	26-25-25S 026-13-38E	070731	5,000	Masonry/ []	Parabolic dish Parabolic dish
14	Hartebeesfontein Radrel Sta	26-39-33S 026-29-12E	070732	5,217	Masonry/ []	Parabolic dish Parabolic dish
15	Hartebeesfontein AM BC Sta	26-46-25S 026-23-21E	070779	5,000	Vertical Radiator/ []	Undet
16	Klerksdorp Radrel Sta	26-51-30S 026-35-00E	070780	4,200	Masonry/26	Parabolic dish Parabolic dish

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
17	Britzkop Radrel Sta	26-46-37S 026-58-00E	070781	4,858	Lattice/	Parabolic dish Parabolic dish
					Lattice/25	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Two masts (each)	Undet
18	Parys Radrel Sta	26-49-13S 027-29-00E	070782	5,557	Lattice/57	Undet
19	Standerton Radrel Sta (see Figs 1 & 2)	26-58-23S 029-12-21E	070783	5,600	Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Lattice/	Parabolic dish Parabolic dish Parabolic dish
					Lattice/	Parabolic dish Parabolic dish Parabolic dish
20	Volksrust AM BC Sta	27-19-20S 029-53-09E	070784	6,720	Vertical Radiator/173	Undet
21	Keimoes Radrel Sta (Ucon)	28-14-34S 020-22-46E	070754	2,990	Masonry/foundation only	--
22	Upington Radrel Sta North	28-18-00S 021-15-00E	070785	3,000	Masonry/	Parabolic dish*
23	Upington Radrel Sta East	28-28-49S 021-36-37E	070742	3,500	Masonry/	Parabolic dish Parabolic dish
24	Groblersthoop Radrel Sta North	28-44-48S 021-59-42E	070763	3,000	Lattice/	Undet
25	Clifton Radrel Sta SW	28-40-15S 022-09-04E	070752	4,300	Lattice/19	Parabolic dish Parabolic dish
26	Groblersthoop Radrel Sta NE	28-43-30S 022-28-55E	070764	5,300	Masonry/22	Parabolic dish Parabolic dish

* Multiple look-angles on high-resolution imagery confirmed the presence of only one antenna.

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
27	Postmasburg Radrel Sta NW	28-04-52S 022-41-46E	070765	5,019	Lattice/	Parabolic dish
28	Griquatown Radrel Sta	28-40-41S 023-11-16E	070766	5,272	Masonry/39	Parabolic dish Parabolic dish
29	Campbell Radrel Sta	28-48-20S 023-38-40E	070767	4,500	Masonry/48	Parabolic dish Parabolic dish
30	Kimberly Radrel Sta SW	28-49-18S 024-23-47E	070768	3,769	Masonry/63	Undet
31	Warrenton Radrel Sta	28-09-52S 025-12-03E	070770	4,334	Masonry/	Parabolic dish Parabolic dish
32	Bloemfontein Radrel Sta NW	28-57-44S 025-42-24E	070772	4,212	Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
33	Theunissen FM Xmtr SABC	28-10-54S 026-32-00E	070773	5,327	Vertical Radiator/264	Undet
34	Hennenman Radrel Sta	27-56-25S 026-59-22E	070774	4,750	Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
35	Bloemfontein AM Xmtr A Radrel Sta	29-06-55S 026-14-26E	070775	5,500	Vertical Radiator/	Undet
					Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
36	Ficksburg Radrel Sta	28-53-56S 027-49-39E	070776	5,500	Masonry/34	Parabolic dish
37	Bethlehem AM BC Sta	28-13-55S 028-30-00E	070777	6,528	Vertical Radiator/178	Undet
38	Ladysmith AM BC A Radrel Sta NE	28-09-41S 029-56-44E	070778	6,089	Vertical Radiator/	Undet
					Lattice/	Parabolic dish Parabolic dish

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
39	Dundee Radrel Sta	28-08-41S 030-12-37E	070756	5,220	Lattice/55	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Lattice/undet	Parabolic dish Parabolic dish
40	Eshowe FM Xmtr SABC	28-52-07S 031-17-01E	070757	3,408	Vertical Radiator/165	Undet
41	Hillcrest FM Xmtr SABC A Radrel Sta	29-46-56S 030-43-14E	070758	3,572	Vertical Radiator/240	Undet
					Lattice/55	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Lattice/55	Parabolic dish
42	Donnybrook AM BC Sta	29-55-46S 029-51-13E	070759	5,600	Vertical Radiator/147	Undet
43	Quthing AM BC Sta (Lesotho)	30-27-12S 027-59-37E	070760	8,000	Vertical Radiator/	Undet
44	Edenburg Radrel Sta	29-51-56S 025-57-22E	070761	5,115	Lattice/69	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
45	Strydenburg Radrel Sta	29-51-56S 023-55-52E	070762	4,312	Masonry/	Parabolic dish Parabolic dish Parabolic dish
46	Britstown Radrel Sta North	30-21-01S 023-35-28E	070816	4,112	Masonry/36	Parabolic dish Parabolic dish
47	Britstown Radrel Sta South	30-44-21S 023-28-33E	070817	4,412	Masonry/	Parabolic dish Parabolic dish
48	Grobbershoop Radrel Sta NNE	28-49-30S 022-02-24E	070818	3,410	Masonry/35	Parabolic dish Parabolic dish
49	Grobbershoop AM BC A Radrel Sta West	28-52-39S 021-43-34E	070753	4,801	Vertical Radiator/245	Undet
					Lattice/	Parabolic dish Parabolic dish Parabolic dish

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
50	Kenhardt Radrel Sta NE	29-09-02S 021-21-17E	070819	3,000	Lattice/81	Undet
51	Groot Zwartdas Radrel Sta	29-32-29S 020-46-28E	070820	3,000	Lattice/107	Undet
52	Dagab Radrel Sta	29-46-24S 020-22-29E	070821	3,000	Lattice/84	Undet
53	Welkom TV BC A Radrel Sta	27-59-34S 026-44-38E	070961	4,780	Masonry []	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
54	Beaufort West Radrel Sta SW	32-35-33S 022-16-52E	070822	2,500	Masonry []	Parabolic dish Parabolic dish
55	Cradock Radrel Sta	32-08-28S 025-38-40E	070823	3,285	Lattice []	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
56	Cookhouse Radrel Sta	32-42-17S 025-48-50E	070824	3,285	Lattice/21	Parabolic dish Parabolic dish Parabolic dish
57	Butterworth AM BC Sta	32-17-01S 028-12-27E	070825	1,750	Vertical Radiator/241	Undet
58	Kalahari AM BC A Radrel Sta (see Fig 3)	27-50-30S 021-35-42E	070826	3,000	Vertical Radiator []	Parabolic dish
59	Bedford AM BC Sta	32-48-41S 026-02-51E	070827	4,970	Vertical Radiator/147	Undet
60	Fort Beaufort Radrel Sta	32-26-16S 026-39-07E	070828	5,250	Masonry/44	Undet
61	Keiskammahoek FM Xmtr SABC Radrel Sta	32-41-35S 027-16-10E	070749	4,660	Vertical Radiator []	Undet
					Lattice/22	Undet
62	Pietersburg Radrel Sta NE	23-41-13S 029-35-59E	070750	4,592	Masonry/24	Parabolic dish Parabolic dish
63	Pietersburg AM BC Sta	23-59-45S 029-28-27E	070751	4,592	Vertical Radiator []	Undet

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
64	Sishen Radrel Sta North	27-45-07S 023-01-34E	070741	4,000	Lattice/undet	Under
65	Sishen Radrel Sta SW	27-57-12S 022-52-45E	070874	4,000	Lattice/undet	Undet
66	Postmasburg Radrel Sta WNW	28-09-07S 022-38-08E	070873	4,000	Lattice/undet	Undet
67	Clifton Radrel Sta North	28-29-17S 022-17-15E	070872	3,000	Lattice/undet	Undet
68	Kenhardt Radrel Sta NW	29-18-35S 021-03-36E	070846	3,000	Lattice/undet	Undet
69	Brandvlet Radrel Sta NNW	30-00-43S 020-08-13E	070871	3,000	Lattice/undet	Undet
70	Brandvlet Radrel Sta NW	30-13-36S 019-51-22E	070870	3,000	Lattice/undet	Undet
71	Loeriesfontein Radrel Sta North	30-36-00S 019-20-16E	070831	2,500	Lattice/undet	Undet
72	Loeriesfontein Radrel Sta West	30-58-02S 018-59-31E	070830	1,500	Lattice/undet	Undet
73	Vanhynsdorp Radrel Sta	31-19-32S 018-47-09E	070829	660	Lattice/undet	Undet
74	Vrendendal Radrel Sta North	31-35-26S 018-29-55E	070867	330	Lattice/undet	Undet
75	Vrendendal Radrel Sta SW	31-47-15S 018-13-58E	070866	165	Lattice/undet	Undet
76	Lamberts Bay Radrel Sta	32-13-07S 018-20-01E	070865	310	Lattice/undet	Undet
77	Elandsbaai Radrel Sta	32-19-48S 018-19-18E	070848	630	Lattice/undet	Undet
78	Velddrif Radrel Sta	32-38-37S 018-18-18E	070847	324	Lattice/undet	Undet
79	Welkom Radrel Sta North	27-56-00S 026-45-00E	070960	4,500	Lattice	Parabolic dish
80	Orkney Radrel Sta	26-54-52S 026-47-05E	070962	4,300	Lattice	Parabolic dish
81	Cape Town Radrel Sta NE	33-50-00S 018-36-27E	070745	1,360	Masonr	Parabolic dish Parabolic dish

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
82	Paarl AM BC Sta	33-42-50S 018-56-30E	070736	2,000	Vertical Radiator/143	Undet
83	Calvinia AM BC A Radrel Sta	31-23-12S 019-47-22E	070845	5,928	Vertical Radiator/	Parabolic dish
84	Greyton Radrel Sta	34-01-06S 019-41-00E	070746	4,500	Lattice/35	Undet
85	Napier FM Xmtr SABC	34-31-30S 019-54-15E	070733	1,800	Vertical Radiator/204	Undet
86	Swellendam Radrel Sta	34-00-30S 020-28-00E	070748	590	Lattice/24	Undet
87	Heidelberg Radrel Sta	34-00-30S 020-58-30E	070755	1,800	Lattice/	Undet
88	Riversdale AM BC Sta	34-01-00S 021-07-40E	070737	2,109	Vertical Radiator/143	Undet
89	Albertina Radrel Sta	34-12-30S 021-41-55E	070747	1,575	Lattice/	Undet
90	Oudtshoorn AM BC Sta	33-41-15S 022-15-55E	070735	2,591	Vertical Radiator/141	Undet
91	George Intl Radcom Xmtr Rcir Govt	33-55-30S 022-27-00E	070734	2,359	Vertical Radiator/141	Undet
92	Laingsburg Radrel Sta East	33-08-44S 021-11-58E	070833	3,000	Masonry/undet	Parabolic dish
93	Fraserburg Road Radrel Sta	32-54-26S 021-45-37E	070869	2,455	Masonry/	Parabolic dish Parabolic dish
94	Beaufort West Radrel Sta	32-21-02S 022-34-49E	070868	3,000	Masonry/36	Parabolic dish Parabolic dish
95	Brocks Store Radrel Sta	32-06-29S 023-02-31E	070835	4,568	Masonry/	Parabolic dish Parabolic dish Parabolic dish
96	Victoria West Radrel Sta	31-33-55S 023-03-15E	070834	5,278	Masonry/undet	Parabolic dish Parabolic dish
97	Laingsburg AM BC A Radrel Sta West	33-17-23S 020-29-55E	070832	5,136	Vertical Radiator/	Undet
					Masonry/	Parabolic dish Parabolic dish

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
98	Worcester Radrel Sta	33-38-25S 019-27-00E	070936	640	Masonry/undet	Undet
99	Wellington Radrel Sta	33-41-10S 019-06-20E	070937	4,000	Masonry	Parabolic dish Parabolic dish
100	Villiersdorp AM BC Sta	33-58-10S 019-30-30E	070938	5,870	Vertical Radiator/141	Undet
101	Kuruman AM BC Sta	27-53-55S 023-33-14E	070939	6,780	Vertical Radiator/undet	Undet
102	Touwsrivier AM BC Sta	33-30-40S 019-49-25E	070940	4,000	Vertical Radiator/undet	Undet
103	George Radrel Sta	33-58-00S 022-27-00E	070744	1,020	Lattice	Parabolic dish Parabolic dish Parabolic dish
104	Prieska AM BC Sta	30-27-58S 024-00-09E	070941	5,133	Vertical Radiator/240	Undet
105	Victoria West Radrel Sta North	31-02-28S 023-08-04E	070942	5,045	Masonry	Parabolic dish Parabolic dish
106	De Aar AM BC Sta	30-27-58S 024-00-09E	070927	6,005	Vertical Radiator/201	Undet
107	Hopetown Radrel Sta	29-37-58S 024-28-55E	070930	4,000	Masonry/undet	Parabolic dish
108	Kimberly Radrel Sta	28-44-20S 024-46-10E	070931	3,900	Lattice	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
109	Kimberly AM BC Sta	28-52-30S 024-54-20E	070932	5,002	Vertical Radiator/231	Undet
110	De Werf Radrel Sta	28-58-20S 025-05-00E	070933	4,137	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish
111	Kuruman Radrel Sta	27-25-31S 023-19-26E	070934	5,277	Lattice/undet	Undet
112	Vryburg Radrel Sta	26-57-23S 024-44-10E	070935	3,900	Lattice/undet	Parabolic dish
113	Lichtenburg Radrel Sta	26-09-40S 026-10-20E	070920	4,800	Masonry/undet	Parabolic dish

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
114	Piketburg FM Xmtr SABC	32-49-29S 018-44-23E	070921	3,370	Vertical Radiator/171	Undet
115	Loeriesfontein Radrel Sta NW	30-44-53S 019-09-49E	070922	3,000	Lattice/undet	Undet
116	Cape Town FM Xmtr Constantiaberg SABC	34-03-44S 018-23-25E	070923	3,440	Vertical Radiator/146	Undet
117	Port Elizabeth AM BC Sta West	33-56-25S 025-25-50E	070924	1,286	Vertical Radiator/204	Undet
118	Port Elizabeth AM Xmtr SABC	33-56-05S 025-33-40E	070925	377	Vertical Radiator/122	Undet
119	Port Elizabeth Radrel Sta	33-55-20S 025-35-40E	070926	160	Lattice/82	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
120	Greytown FM Xmtr SABC	29-01-34S 030-32-28E	070875	5,722	Vertical Radiator/171	Undet
121	Ladysmith Radrel Sta South	28-36-07S 029-47-13E	070876	3,858	Lattice/	Parabolic dish Parabolic dish
122	Andalusia AM BC A Radrel Sta	27-54-23S 024-56-21E	070877	5,034	Vertical Radiator/261 Lattice/undet	Undet Parabolic dish Parabolic dish Parabolic dish
123	Schweizer-Reneke AM BC Sta	27-08-00S 025-13-15E	070878	5,444	Vertical Radiator/260	Undet
124	Grahamstown FM Xmtr SABC A Rdl Sta E	33-17-44S 026-42-17E	070918	3,366	Vertical Radiator/204 Lattice/undet Lattice/undet	Undet Parabolic dish Undet
125	East London Radrel Sta West	33-01-17S 027-36-51E	070919	960	Lattice/undet	Undet
126	Potchefstroom Radrel CCT Drop Mpt	26-43-30S 027-06-00E	071078	4,300	Lattice/42	Parabolic dish Parabolic dish
127	Alexandria Radrel Sta	33-37-26S 026-04-57E	070943	1,120	Masonry/undet	Parabolic dish

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
128	Grahamstown AM Xmtr SABC	33-20-37S 026-30-29E	070944	2,649	Vertical Radiator/101	Undet
129	Grahamstown Radrel Sta West	33-19-23S 025-56-07E	070945	2,761	Lattice/61	Parabolic dish Parabolic dish
130	Queenstown AM BC A Radrel Sta	31-44-54S 026-46-14E	070946	7,021	Vertical Radiator/143	Undet
131	Melkbosstrand Radrel Sta	33-43-54S 018-26-46E	070947	262	Masonry/ Lattice/	Parabolic dish Parabolic dish
132	Cape Town Radrel Sta	33-55-42S 018-25-01E	070959	624	Lattice/	Parabolic dish Parabolic dish Parabolic dish
133	East London Radrel Sta	33-00-45S 027-53-25E	070948	50	Lattice/	Parabolic dish Parabolic dish
134	Nylstroom Radrel Sta	24-47-20S 028-26-55E	070949	4,500	Masonry/undet	Parabolic dish Parabolic dish
135	Thabazimbi AM BC Sta	24-28-45S 027-36-35E	071057	6,724	Vertical Radiator/180	Undet
136	Pretoria Radrel Sta South	25-45-59S 028-11-20E	070951	494	Lattice/undet	Parabolic dish
137	Pretoria Radrel Sta SE	25-49-59S 028-15-19E	070952	5,000	Lattice/undet	Parabolic dish Parabolic dish
138	Vereeniging Radrel Sta	26-39-05S 028-08-53E	070954	5,636	Masonry/undet	Parabolic dish Parabolic dish
139	Welverdiend AM/FM BC Sta	26-25-59S 027-15-00E	070955	5,113	Vertical Radiator/undet	Undet
140	Hekpoort Radrel Sta	25-54-10S 027-42-10E	070956	6,000	Masonry/	Parabolic dish
141	Boschfontein Radrel Sta	25-52-15S 027-25-55E	070957	5,860	Masonry/undet	Parabolic dish
142	Rustenburg Radrel Sta	25-41-26S 027-15-03E	070958	3,940	Lattice/undet Masonry/	Undet Parabolic dish
143	Kroonstad FM Xmtr SABC A Radrel Sta	27-36-39S 027-15-38E	070963	4,700	Lattice/	Undet

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
144	Richards Bay Radrel Sta (Ucon)	28-47-20S 032-06-20E	070964	210	Lattice/undet	Undet
145	Vissershoeck Radrel Sta	25-41-17S 027-59-03E	070965	5,466	Lattice/108	Parabolic dish Parabolic dish
146	Rustenburg FM Xmtr SABC	25-37-00S 027-07-15E	070966	5,227	Vertical Radiator/112	Undet
147	Ermelo AM BC Sta	26-30-32S 030-00-22E	071047	5,700	Vertical Radiator/55	Undet
148	Meerhof AM BC Sta	25-45-30S 027-54-02E	070967	3,900	Vertical Radiator/	Undet
149	Paardekop Radrel Sta	27-10-40S 029-41-25E	071048	6,108	Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
150	Volkstrust Radrel Sta	27-19-20S 029-53-50E	071049	6,220	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
151	Durban Radrel Sta	29-54-23S 031-02-12E	071050	289	Lattice/	Parabolic dish Parabolic dish
152	Brakpan AM BC Sta	26-11-00S 028-31-20E	071051	5,500	Vertical Radiator/91	Undet
153	Heidelberg AM BC Sta	26-29-35S 028-21-05E	071052	5,255	Vertical Radiator/undet	Undet
154	Heidelberg Radrel Sta	26-30-05S 028-22-10E	071053	5,005	Masonry/undet	Parabolic dish
155	Piketburg Radrel Sta	32-50-46S 018-44-40E	071054	2,474	Lattice/100	Undet
156	Carletonville Radrel TMNL Mpt	26-21-50S 027-24-05E	071055	5,000	Lattice/undet	Undet
157	Pretoria Radrel Sta SW	25-46-30S 028-09-20E	071056	5,100	Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
158	Cape Town Intl Radcom Rcvr UK	33-52-35S 018-30-20E	None	300	Lattice/	Prob parabolic dish Prob parabolic dish

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
159	Klerksdorp Radrel Tmnl Mpt	26-53-13S 026-40-20E	071079	4,100	Lattice/49	Undet
160	Van Kolderskop Radrel Sta	26-40-00S 028-43-20E	071075	5,250	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Lattice/undet	Undet
					Lattice/undet	Undet
161	La Belle Esperance Radrel Sta	27-31-49S 029-45-15E	071076	6,500	Lattice/31	Parabolic dish Parabolic dish
162	Newcastle Radrel Sta	27-43-00S 029-57-10E	071077	4,250	Lattice	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
163	Nottingham Road Radrel Sta	29-20-25S 030-02-00E	071074	5,280	Lattice/Undet	Undet
164	Soutpansfontein Radrel Sta	30-34-11S 019-26-31E	071141	2,812	Lattice/undet	Undet
165	Moorivier AM BC Sta	29-11-50S 029-52-00E	071308	5,691	Vertical Radiator/174	Poss parabolic dish
166	Titarn AM BC Sta	29-11-36S 029-50-43E	071307	5,463	Vertical Radiator/122	Undet
167	Johannesburg FM Xmtr Brixton SABC	26-11-00S 028-00-00E	071246	5,923	Vertical radiator/ masonry tower height	Undet
168	Johannesburg Tp Exch/ Coax/Radrel Facs	26-12-20S 028-02-16E	071247	5,830	Vertical radiator/ masonry tower/222; overall height 266	Parabolic dish Parabolic dish **
169	Hertzberg Radrel Sta	29-34-10S 026-03-55E	071465	4,580	Lattice/67	Parabolic dish Parabolic dish
170	Springfontein Radrel Sta	30-17-32S 025-38-23E	071466	5,500	Lattice/undet	Parabolic dish Parabolic dish

** According to a collateral document,³ there are 13 microwave antennas encircling the upper levels of this tower. The line-of-sight distance for these antennas reportedly approaches 100 miles in some directions.

Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
171	Springfontein AM BC Sta	30-16-20S 025-46-15E	071467	5,729	Vertical Radiator/143	Undet
172	Kroonstad AM BC A Radrel Sta NNW	27-25-30S 027-11-00E	071468	3,160	Vertical Radiator/235	Undet
173	Donkerpoort Radrel Sta	30-36-50S 025-28-59E	071469	4,000	Lattice/undet	Parabolic dish Parabolic dish
174	Christiana Radrel Sta	27-50-11S 025-28-00E	071470	4,263	Masonry/undet	Parabolic dish Parabolic dish
175	Bloemhof Radrel Sta	27-28-56S 025-43-28E	071471	4,264	Masonry/undet	Parabolic dish Parabolic dish
176	Wolmaransstad Radrel Sta	27-12-38S 026-04-04E	071347	4,500	Masonry/undet	Parabolic dish
177	Bloemfontein AM BC Sta South	29-15-10S 026-13-00E	071348	4,600	Vertical Radiator/158	Undet
178	Brandfort Radrel Sta	28-41-30S 026-28-00E	071349	5,000	Lattice/undet	Parabolic dish Parabolic dish
179	Theunissen Radrel Sta	28-21-58S 026-39-30E	071350	4,500	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish
180	Colesburg Radrel Sta	30-45-30S 025-03-30E	071351	5,000	Lattice/undet	Parabolic dish Parabolic dish
181	Noupoort AM BC A Radrel Sta	31-18-10S 024-56-10E	071352	6,116	Vertical Radiator/173	Undet
182	Riebeeckstad Radrel Sta	27-51-30S 026-56-10E	071491	4,750	Lattice/	Parabolic dish Parabolic dish
183	Clarkson AM BC A Radrel Sta	34-01-30S 024-26-00E	071490	2,493	Vertical Radiator/103	Undet
					Lattice/	Parabolic dish Parabolic dish Parabolic dish Parabolic dish

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Table 1 (Continued)

Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
184	Estcourt Radrel Sta	29-06-12S 029-58-00E	071564	5,000	Lattice [redacted]	Parabolic dish Parabolic dish Parabolic dish Parabolic dish Parabolic dish
					Lattice [redacted]	Parabolic dish Parabolic dish
185	Scottburg AM BC A Radrel Mpt	30-17-00S 030-45-00E	071656	61	Vertical Radiator/undet	Parabolic dish Parabolic dish
186	Hibberdene Radrel Sta	30-35-10S 030-33-30E	071655	40	Lattice/undet	Undet
187	Port Shepstone FM Xmtr SABC	30-43-00S 030-17-00E	071657	558	Vertical Radiator/62	Undet
188	Matatiele AM/FM BC Sta	30-23-50S 028-49-20E	071654	6,752	Vertical Radiator [redacted]	Undet
189	Cedarville AM BC Sta	30-19-00S 029-00-00E	071653	5,007	Vertical Radiator/136	Undet
190	Saldanha Radrel Sta	33-00-11S 017-52-50E	071652	40	Masonry [redacted]	Parabolic dish
191	Vishoek Radrel Sta	34-09-50S 018-25-30E	071658	975	Masonry [redacted]	Parabolic dish Parabolic dish
192	Belfast Radrel Sta	25-31-25S 029-59-58E	071767	6,620	Lattice [redacted]	Parabolic dish Parabolic dish
193	Grabouw Radrel Sta	34-06-42S 018-58-31E	071766	1,078	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish
194	Lydenburg Radrel Sta	25-08-30S 030-37-00E	071769	7,000	Lattice/undet	Parabolic dish Parabolic dish
195	Nelspruit Radrel Sta	25-26-45S 030-57-05E	071768	3,000	Lattice [redacted]	Parabolic dish Parabolic dish
196	Knysna Radrel Sta	33-58-25S 023-08-50E	071770	1,600	Lattice/72	Parabolic dish Parabolic dish
197	Hendrina Radrel Sta	26-06-55S 029-34-30E	071747	6,000	Masonry [redacted]	Parabolic dish Parabolic dish
198	Van Stadens Radrel Sta	33-53-20S 025-15-58E	071748	1,945	Lattice/undet	Parabolic dish Parabolic dish Parabolic dish

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Table 1 (Continued)

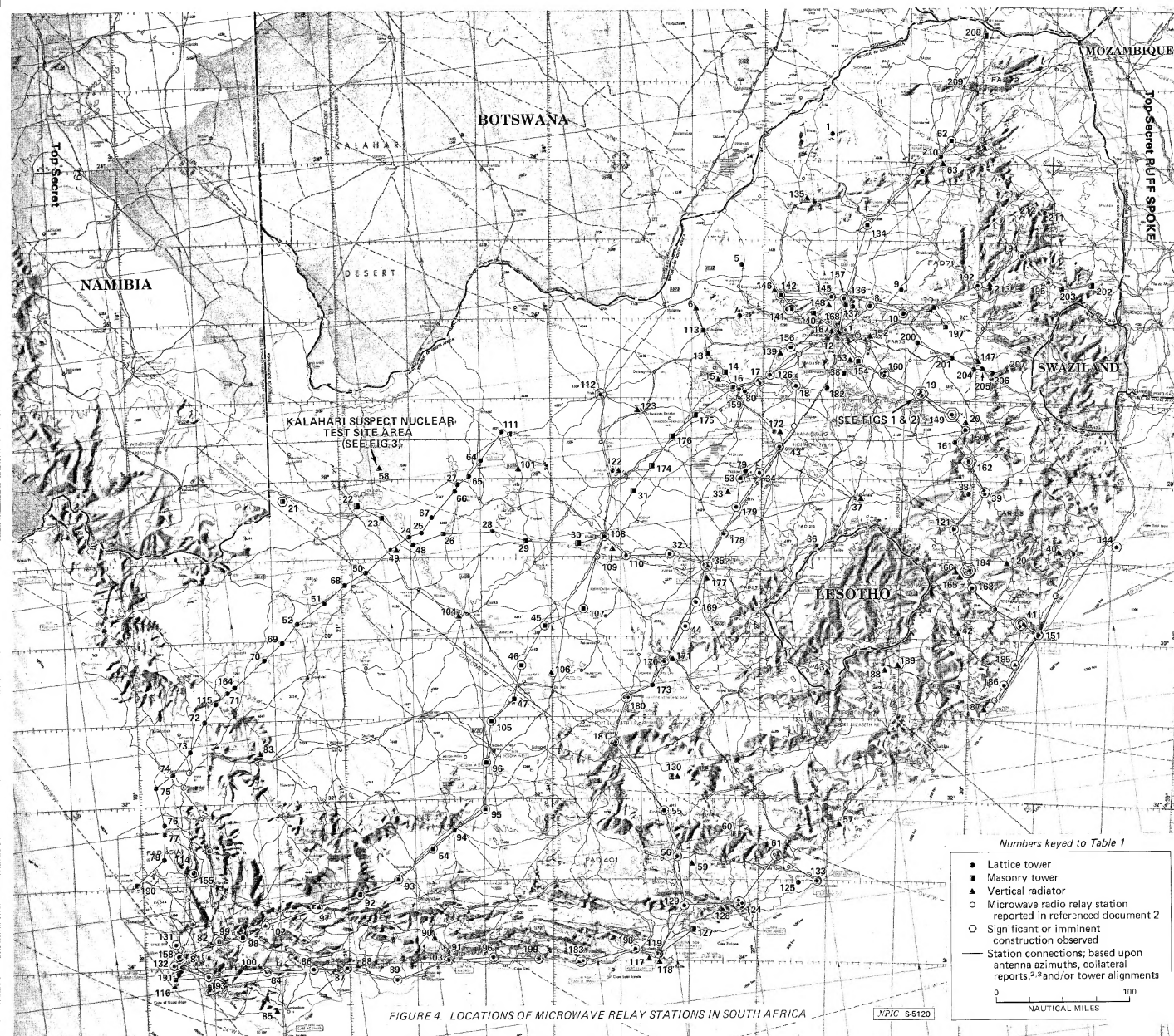
Site No	Facility	Geographic Coordinates	MRN No	Approx Site Elev (ft)	Tower Type/Height (m)	Microwave Radio Relay Antenna Type
199	Stormsrivier Radrel Sta	33-59-00S 023-48-56E	071749	700	Lattice	Parabolic dish Parabolic dish Parabolic dish
200	Kriel TPP Radrel Sta	26-15-25S 029-10-35E	071750	5,321	Lattice/undet	Parabolic dish
201	Davel Pipeline Radrel Sta	26-27-35S 029-39-00E	071751	5,730	Lattice/undet	Parabolic dish Parabolic dish
202	Malelane Radrel Sta	25-29-28S 031-38-33E	071752	2,560	Masonry/20	Parabolic dish
203	Krokodilpoort Radrel Sta	26-32-40S 031-11-30E	071753	3,250	Masonry	Parabolic dish
204	Ermelo Pipeline Radrel Sta	26-35-40S 029-58-30E	071754	5,580	Lattice/undet	Parabolic dish Parabolic dish
205	Camden Pipeline Radrel Sta	26-36-10S 030-05-15E	071760	5,238	Lattice/undet	Parabolic dish
206	Sheepmoor Pipeline Radrel Sta	26-39-30S 030-14-55E	071761	5,120	Lattice/undet	Undet
207	Amsterdam Pipeline Radrel Sta	26-38-50S 030-28-00E	071762	4,800	Lattice/undet	Undet
208	Messina Radrel Sta	22-21-10S 030-02-00E	071763	1,800	Masonry	Parabolic dish Parabolic dish
209	Louis Trichardt AM BC Sta	23-00-00S 029-45-55E	071764	5,665	Vertical Radiator/undet	Undet
210	Pietersburg Radrel Sta	23-55-00S 029-26-55E	071765	4,160	Lattice/79	Parabolic dish Parabolic dish Parabolic dish Parabolic dish
211	Mariepskop Radar Fac	24-33-10S 030-52-20E	071464	6,381	Lattice/undet	Parabolic dish
212	Angledale AM/FM BC Sta	24-33-00S 030-52-10E	071771	6,381	Vertical Radiator/undet	Undet
213	Moreskop AM BC A Radrel Sta	25-34-25S 030-11-20E	071772	6,625	Vertical Radiator/undet Lattice/undet	Undet Undet

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List of Conversion Factors by Classification

UNITS OF LENGTH

<i>IF YOU HAVE</i>	<i>MULTIPLY BY</i>	<i>TO OBTAIN</i>
MILLIMETERS	0.0394	INCHES
CENTIMETERS	0.3937	INCHES
INCHES	25.4000	MILLIMETERS
INCHES	2.5400	CENTIMETERS
FEET	0.3048	METERS
FEET	0.0003	KILOMETERS
YARDS	0.9144	METERS
METERS	3.2808	FEET
METERS	0.0005	MILES(NAUTICAL)
METERS	1.0936	YARDS
KILOMETERS	3280.8400	FEET
KILOMETERS	0.6214	MILES(STATUTE)
KILOMETERS	0.5400	MILES(NAUTICAL)
MILES(STATUTE)	1.6093	KILOMETERS
MILES(NAUTICAL)	6076.1154	FEET
MILES(NAUTICAL)	1.8520	KILOMETERS
MILES(NAUTICAL)	1852.0000	METERS

UNITS OF MASS

<i>IF YOU HAVE</i>	<i>MULTIPLY BY</i>	<i>TO OBTAIN</i>
KILOGRAMS	2.2046	POUNDS(AVOIR.)
POUNDS(AVOIR.)	0.4536	KILOGRAMS
SHORT TONS	0.9072	METRIC TONS
METRIC TONS	1.1023	SHORT TONS
METRIC TONS	0.9842	LONG TONS
LONG TONS	1.0160	METRIC TONS

UNITS OF VOLUME

<i>IF YOU HAVE</i>	<i>MULTIPLY BY</i>	<i>TO OBTAIN</i>
LITERS	0.2642	GALLONS
LITERS	0.0063	BARRELS(POL)
LITERS	0.0010	CUBIC METERS
GALLONS	3.7854	LITERS
GALLONS	0.1337	CUBIC FEET
GALLONS	0.0238	BARRELS(POL)
GALLONS	0.0038	CUBIC METERS
BUSHELS	0.0352	CUBIC METERS
CUBIC FEET	7.4805	GALLONS
CUBIC FEET	0.1781	BARRELS(POL)
CUBIC FEET	0.0283	CUBIC METERS
CUBIC YARDS	0.7646	CUBIC METERS
BARRELS(POL)	158.9873	LITERS
BARRELS(POL)	42.0000	GALLONS
BARRELS(POL)	5.6146	CUBIC FEET
BARRELS(POL)	0.1590	CUBIC METERS
CUBIC METERS	1000.0000	LITERS
CUBIC METERS	264.1721	GALLONS
CUBIC METERS	35.3147	CUBIC FEET
CUBIC METERS	28.3776	BUSHELS
CUBIC METERS	6.2898	BARRELS(POL)
CUBIC METERS	1.3080	CUBIC YARDS

UNITS OF AREA

<i>IF YOU HAVE</i>	<i>MULTIPLY BY</i>	<i>TO OBTAIN</i>
SQUARE CENTIMETERS	0.1550	SQUARE INCHES
SQUARE INCHES	6.4516	SQUARE CENTIMETERS
SQUARE FEET	0.0929	SQUARE METERS
SQUARE YARDS	0.8361	SQUARE METERS
SQUARE METERS	10.7639	SQUARE FEET
SQUARE METERS	1.1960	SQUARE YARDS
SQUARE METERS	1.0000	CENTARES
SQUARE METERS	0.0002	ACRES
SQUARE METERS	0.0001	HECTARES
ACRES	4046.8564	SQUARE METERS
ACRES	0.4047	HECTARES
HECTARES	10000.0000	SQUARE METERS
HECTARES	2.4711	ACRES

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